construction engineers

...soil surveys can help you

Soil Conservation Service
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CONSTRUCTION ENGINEERS

On many construction projects a major soil hazard is discovered only after the site has been selected and construction is underway. The unforeseen hazard generally leads to delays in construction and to cost overruns.

If soil hazards are known before construction begins, special compensating designs can be prepared in advance or alternate sites can be selected. Although nearly any site can be made suitable for most uses if enough money is spent, avoiding poor sites where possible helps keep construction and maintenance costs to a minimum.

This pamphlet tells how soil surveys available from the Soil Conservation Service (SCS) can help engineers anticipate soil-related hazards that affect construction of buildings, highways, pipelines, transmission lines, and similar installations.

Determining Soil Hazards

Soil surveys show the location of each kind of soil in the county or area surveyed and describe the soil properties. These data can help engineers anticipate soil-related problems and plan onsite inspection. Failure to investigate adequately may lead to expensive delays in construction or eventual structural breakdown.

For example, in upper New York state a sewer installation cost $234,000 more than anticipated because lines had to cross areas where bedrock was at a depth of less than 20 inches. Test borings had been made but too few to reveal this hazard. A soil survey of the area available from SCS showed that in places the soil through which the sewer was to be laid was less than 20 inches deep over bedrock.

A new elementary school built in the Midwest at a cost of nearly a million dollars was declared unfit for occupancy after completion because huge cracks had formed in the walls and other structural weaknesses had developed. Repairs cost tens of thousands of dollars. There was nothing wrong with the

Soil surveys provide information about depth to bedrock, the kind of soil material, and other properties that may affect the cost of excavation.

Areas where a severe erosion hazard may lead to damage of pipelines and other structures are indicated in soil surveys.

Soil surveys can help in routing highways, pipelines, transmission lines, and other extensive installations.

Soil surveys indicate hazards of seasonal wetness that may delay construction.

Shrinking and swelling of the soil cracked the wall of this building. Soil surveys give soil properties that indicate such hazards.

Highly corrosive soil damaged this gaspipe. The corrosivity of soils is rated in soil surveys.

design of the building had it been built on stable soil, but it was built on unstable soil. A soil map available from SCS showed that the soil in the area was unstable.

How Soil Surveys Can Help

Construction engineers are particularly interested in soil properties that may require special structural measures to overcome or special maintenance once construction is completed. Soil surveys describe important soil properties that affect construction, including the following.

Shrink-swell potential.—Certain kinds of clay soils expand when wet and shrink when dry, and special foundations are required to compensate for this movement. Soil surveys identify soils that have large shrink-swell potential.

Wetness.—Soil surveys provide data on natural soil drainage, permeability, depth to seasonal water table, and suitability for winter grading for various kinds of soils. They can help engineers anticipate seasonal limitations on the use of heavy machinery for earthmoving and compacting and estimate the hazard of flooding or damage to underground structures caused by soil wetness.

Depth to bedrock.—Soil surveys show areas where bedrock is at a depth of less than 5 or 6 feet and indicate the kind of bedrock.

Erodibility.—Soil surveys provide information on how susceptible each soil is to erosion. Slope is only one factor contributing to erodibility. Other soil properties are also important, especially those properties that determine the cohesiveness of soil particles. These properties commonly vary within different layers of the same soil and cause different degrees of erodibility in different soil layers.

Flood hazard.—The hazards of flooding and ponding are rated in soil surveys, and flood-prone areas are shown on soil maps. Such information does not take the place of hydrologic studies to determine the severest flood expected once in 10, 25, 50, or 100 years, but it does provide reliable estimates of areas where floods are most likely.

Slope.—Slope gradient is a determining factor in establishing the final grade of a construction site and the amount of cut and fill needed to achieve the final grade. Ranges in slope are recorded in soil surveys, and areas where cuts and fills may be needed can be identified by studying soil maps. Slope particularly affects the installation of underground conduits and the construction of roads and highways.

Bearing capacity.—Soil surveys give estimates of the particle size and plasticity of soils, and each soil layer is classified according to the Unified and the AASHO systems. These classifications help in evaluating soils for shallow foundations and determining ease of compaction, ease of winter grading, trafficability, density, moisture relationships, susceptibility to frost action, and other properties.

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corrodes in soils that are highly saline or acid. The corrosion potential of each kind of soil is rated in soil surveys.

Organic layers.—Muck and peat are very soft and unstable, and if drained, they subside. Areas of organic soils are shown in soil surveys, and the thickness of organic layers is indicated.

Ease of excavation.—Excavating friable soils may cost half as much as excavating soils that are hard and compact. Sticky, clayey soils are difficult to spread in thin layers. Some soils are very susceptible to sloughing in trenches; others are stable. All these properties may differ from layer to layer in the same soil. Data presented in soil surveys can be used by engineers to anticipate earthmoving problems and to prepare more accurate bids for earthmoving.

Soil surveys also provide interpretations of the effect of soil properties on many kinds of land use. These interpretations and other data can be used to determine soil suitability as a source of topsoil, sand and gravel, roadfill for highway subgrade, and impermeable material. The interpretations also show the degree and kind of limitations of soils if used for septic tank absorption fields, foundations for low buildings, underground utility lines, pipelines, highways, roads, streets, and parking lots.

How to Obtain a Soil Survey

You can call the local office of the Soil Conservation Service to determine whether a soil survey of the area that interests you is available. If the survey has not yet been published, you can arrange to examine maps and data available in preliminary form.

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